

WHAT IS CLAIMED IS:

1 1. A photoreceptor cleanerless image forming apparatus to
2 overlappingly form yellow, magenta, cyan, and black toner images,
3 wherein said apparatus is conditioned to decrease color
4 mixture or exposure error with respect to at least one of an
5 exposure intensity, an exposure resolution, a volume-based
6 average particle diameter of toner, a light source wavelength,
7 a layer thickness of toner to be transferred, and the weight-
8 based average charged amount of toner.

1 2. The image forming apparatus according to claim 1,
2 wherein said apparatus is a 4-drum tandem image forming
3 apparatus comprising four photoreceptor cleanerless image
4 forming units each including at least a photoreceptor, a charger,
5 an exposure apparatus, and a developing apparatus for
6 overlappingly forming yellow, magenta, cyan, and black images;
7 and
8 exposure intensities I_y , I_c , I_m , and I_k are configured to
9 satisfy conditions of $I_k \geq I_c \geq I_m \geq I_y$ and $I_k > I_y$, where said
10 exposure intensities I_y , I_c , I_m , and I_k correspond to exposure
11 sources for exposure apparatuses in image forming units to form
12 yellow, magenta, cyan, and black images, respectively.

1 3. The image forming apparatus according to claim 2,
2 wherein said image forming unit is provided with a transfer
3 condition so adjusted that the sum of layer thicknesses for
4 untransferred toner and reverse transfer toner becomes

5 100[g/cm²] or less during transfer of a solid image.

1 4. The image forming apparatus according to claim 2,
2 wherein said exposure source complies with a red or
3 near-infrared area whose center wavelength is 630 nm or more.

1 5. The image forming apparatus according to claim 2,
2 wherein said exposure source is a semiconductor laser.

1 6. The image forming apparatus according to claim 1,
2 wherein said apparatus is a 4-drum tandem image forming
3 apparatus comprising four photoreceptor cleanerless image
4 forming units each including at least a photoreceptor, a charger,
5 an exposure apparatus, and a developing apparatus for
6 overlappingly
7 forming yellow, magenta, cyan, and black images; and
8 exposure resolutions Ry, Rm, Rc, and Rk are configured to
9 satisfy conditions of $R_k \leq R_c \leq R_m$ and $R_m > R_k$, where said exposure
10 resolutions Ry, Rm, Rc, and Rk correspond to exposure apparatuses
11 in image forming units to form yellow, magenta, cyan, and black
12 images, respectively.

1 7. The image forming apparatus according to claim 6,
2 wherein said image forming unit is provided with a transfer
3 condition so adjusted that the sum of layer thicknesses for
4 untransferred toner and reverse transfer toner becomes
5 100[g/cm²] or less during transfer of a solid image.

1 8. The image forming apparatus according to claim 6,
2 wherein said exposure source complies with a red or
3 near-infrared area whose center wavelength is 630 nm or more.

1 9. The image forming apparatus according to claim 6,
2 wherein said exposure source is a semiconductor laser.

1 10. The image forming apparatus according to claim 6,
2 wherein beam diameters D_y , D_m , D_c , and D_k are configured
3 to satisfy conditions of $D_k \geq D_c \geq D_m \geq D_y$ and $D_k > D_y$, where
4 said beam diameters D_y , D_m , D_c , and D_k are used for said exposure
5 source to create an electrostatic latent image.

1 11. The image forming apparatus according to claim 6,
2 wherein said exposure resolution R_y equals said exposure
3 resolution R_k .

1 12. The image forming apparatus according to claim 1,
2 wherein said apparatus is a 4-drum tandem image forming
3 apparatus comprising four photoreceptor cleanerless image
4 forming units each including at least a photoreceptor, a charger,
5 an exposure apparatus, and a developing apparatus for
6 overlappingly forming yellow, magenta, cyan, and black images;
7 and

8 exposure resolutions R_y , R_m , R_c , and R_k are configured to
9 satisfy conditions of $R_k \leq R_c \leq R_m \leq R_y$ and $R_y > R_k$, where said
10 exposure resolutions R_y , R_m , R_c , and R_k correspond to image

11 forming units to form yellow, magenta, cyan, and black images,
12 respectively.

1 13. The image forming apparatus according to claim 1,
2 wherein said apparatus comprises four photoreceptor
3 cleanerless developing apparatuses to overlappingly form yellow,
4 magenta, cyan, and black toner images; and
5 volume-based average particle diameters P_a , P_b , P_c , and
6 P_d are configured to satisfy conditions of $P_a \geq P_b \geq P_c \geq P_d$ and
7 $P_a > P_d$, where P_a , P_b , P_c , and P_d indicate volume-based average
8 particle diameters of toners to be developed on a photoreceptor
9 in the order of development.

1 14. The image forming apparatus according to claim 13,
2 wherein said image forming apparatus is configured in
3 4-drum tandem so that four photoreceptor cleanerless image
4 forming units can overlappingly form yellow, magenta, cyan, and
5 black images on a transfer material.

1 15. The image forming apparatus according to claim 13,
2 wherein said image forming apparatus is configured in
3 accordance with a 4-rotation system so that four photoreceptor
4 cleanerless developing apparatuses can overlappingly form yellow,
5 magenta, cyan, and black images on an intermediate transferrer,
6 and then these images are transferred onto a transfer material
7 from said intermediate transferrer at a time.

1 16. The image forming apparatus according to claim 13,
2 wherein a transfer condition is so adjusted that the sum
3 of layer thicknesses for untransferred toner and reverse transfer
4 toner becomes $100[\text{ g/cm}^2]$ or less during transfer of a solid
5 image.

1 17. The image forming apparatus according to claim 13,
2 wherein said exposure source performs exposure within a
3 red or near-infrared area whose center wavelength is 630 nm or
4 more.

1 18. The image forming apparatus according to claim 13,
2 wherein said exposure source is a semiconductor laser.

1 19. The image forming apparatus according to claim 13,
2 wherein the weight-based average charged amounts of yellow,
3 magenta, cyan, and black toners are configured to produce an
4 initial difference within the range of $\pm 5[\text{ C/g}]$.

1 20. The image forming apparatus according to claim 1,
2 wherein said apparatus is a photoreceptor cleanerless image
3 forming apparatus to overlappingly form yellow, magenta, cyan,
4 and black toner images; and
5 an exposure source used for forming an electrostatic latent
6 image complies with a blue or blue-violet area whose center
7 wavelength is 460 nm or less.

1 21. The image forming apparatus according to claim 20,
2 wherein said image forming apparatus is provided with a
3 transfer condition so adjusted that the sum of layer thicknesses
4 for untransferred toner and reverse transfer toner becomes
5 100[g/cm²] or less during transfer of a solid image.

1 22. The image forming apparatus according to claim 20,
2 wherein said image forming apparatus is configured in
3 4-drum tandem so that four photoreceptor cleanerless image
4 forming units can overlappingly form yellow, magenta, cyan, and
5 black images on a transfer material.

1 23. The image forming apparatus according to claim 20,
2 wherein said image forming apparatus is configured in
3 accordance with a 4-rotation system so that four photoreceptor
4 cleanerless image forming units can overlappingly form yellow,
5 magenta, cyan, and black images on an intermediate transferrer,
6 and then these images are transferred onto a transfer material
7 from said intermediate transferrer at a time.

1 24. The image forming apparatus according to claim 1,
2 wherein said apparatus is a 4-drum tandem image forming
3 apparatus comprising four photoreceptor cleanerless image
4 forming units each including at least a photoreceptor, a charger,
5 an exposure apparatus, and a developing apparatus for
6 overlappingly forming yellow, magenta, cyan, and black images;
7 and

8 an exposure source for forming a yellow electrostatic
9 latent image complies with a red or near-infrared area whose
10 center wavelength is 630 nm or more, and an exposure source used
11 for forming at least a cyan electrostatic latent image out of the
12 other electrostatic latent images in the remaining colors
13 complies with a blue or blue-violet area whose center wavelength
14 is 460 nm or less.

1 25. The image forming apparatus according to claim 24,
2 wherein said exposure source is a semiconductor laser.

1 26. The image forming apparatus according to claim 24,
2 wherein said image forming unit is provided with a transfer
3 condition so adjusted that the sum of layer thicknesses for
4 untransferred toner and reverse transfer toner becomes
5 $100[\text{g/cm}^2]$ or less during transfer of a solid image.

1 27. The image forming apparatus according to claim 24,
2 wherein exposure sources for forming magenta and black
3 electrostatic latent images comply with a red or near-infrared
4 area whose center wavelength is 630 nm or more.

1 28. The image forming apparatus according to claim 24,
2 wherein exposure sources for forming magenta and black
3 electrostatic latent images comply with a blue or blue-violet area
4 whose center wavelength is 460 nm or less.

1 29. The image forming apparatus according to claim 1,
2 wherein said apparatus is a photoreceptor cleanerless image
3 forming apparatus to overlappingly form yellow, magenta, cyan,
4 and black toner images; and
5 layer thicknesses Ta, Tb, Tc, and Td are configured to
6 satisfy conditions of $Ta \leq Tb \leq Tc \leq Td$ and $Ta < Td$, where Ta,
7 Tb, Tc, and Td indicate thicknesses of toner layers to be
8 transferred to a transfer material in this order.

1 30. The image forming apparatus according to claim 29,
2 wherein a ratio between X and Y is greater than or equal
3 to 1/25000 and is smaller than or equal to 1/10, where X indicates
4 a layer thickness of a toner image developed on a photoreceptor
5 during solid image formation, and Y indicates a layer thickness
6 of toner returned to a photoreceptor from a solid toner image
7 already transferred to a transfer material.

1 31. The image forming apparatus according to claim 29,
2 wherein said image forming apparatus is configured in
3 4-drum tandem so that four photoreceptor cleanerless image
4 forming units can overlappingly form yellow, magenta, cyan, and
5 black images on a transfer material.

1 32. The image forming apparatus according to claim 29,
2 wherein said four toner images are formed in the order of
3 yellow, magenta, cyan, and black from upstream to downstream.

1 33. The image forming apparatus according to claim 29,
2 wherein said image forming apparatus is configured in
3 accordance with a 4-rotation system so that four photoreceptor
4 cleanerless image forming units can overlappingly form yellow,
5 magenta, cyan, and black images on an intermediate transferrer,
6 and then these images are transferred onto a transfer material
7 from said intermediate transferrer at a time.

1 34. The image forming apparatus according to claim 1,
2 wherein said apparatus is a photoreceptor cleanerless image
3 forming apparatus to overlappingly form yellow, magenta, cyan,
4 and black toner images; and
5 weight-based average charged amounts Q_a , Q_b , Q_c , and Q_d
6 are configured to satisfy conditions of $Q_a \leq Q_b \leq Q_c \leq Q_d$ and Q_a
7 $< Q_d$, where Q_a , Q_b , Q_c , and Q_d indicate weight-based average
8 charged amounts of toners to be transferred to a transfer material
9 in this order.

1 35. The image forming apparatus according to claim 34,
2 wherein volume-based average particle diameters of yellow,
3 magenta, cyan, and black toners are configured to produce an
4 initial difference within the range of $\pm 1[\mu m]$.

1 36. The image forming apparatus according to claim 34,
2 wherein volume-based average particle diameters P_a , P_b ,
3 P_c , and P_d are configured to satisfy conditions of $P_a \geq P_b \geq P_c$
4 $\geq P_d$ and $P_a > P_d$, where P_a , P_b , P_c , and P_d indicate volume-based

5 average particle diameters of toners to be developed on a
6 photoreceptor in this order.

1 37. The image forming apparatus according to claim 34,
2 wherein layer thicknesses Ta, Tb, Tc, and Td are configured
3 to satisfy conditions of $Ta \leq Tb \leq Tc \leq Td$ and $Ta < Td$, where
4 Ta, Tb, Tc, and Td indicate layer thicknesses of toners to be
5 developed on a photoreceptor in this order.